ARRANGEMENT IN A GLASS BENDING OVEN

This invention relates to an arrangement in a glass bending furnace in accordance with the preamble of claim 1 by means of which arrangement formation of glass sheet unloading and glass sheet loading times are prevented as capacity restricting factors.

Previously known are so called serial type bending furnaces, where the glass sheets move for bending on the upper rail and the bent ones back to the loading and reloading place along the lower rail either in carriages with side walls or in open carriages. In these arrangements both the removal of a bent glass sheet and placing a straight blank in the mould are carried out while said carriage is standing still in the lower part of the so called loading lift.

The circulation time of carriage vertical motions including horizontal motions, lift motions, function of side members etc. typically take ab. 30 sec. Then the carriage is immobile in the lower part of said loading lift depending on the capacity of furnace each time. For instance, at a capacity of n pieces/h the time of standing still is (3600 sec)/n - 30 sec.

If, for instance, the required furnace capacity is 60 pieces/h, then there will remain altogether 30 sec time (= 15 sec. + 15 sec.) for unloading and loading. In this case loading and unloading can still be carried out successfully by experienced persons, but two persons would be needed.

However, if one wants to increase the capacity to a quantity of 100 pieces/h, for instance, the so called cycle length will be 36 sec. and altogether 36 sec. - 30 sec. = 6 sec. time will remain for loading and unloading, the job is then impossible.

The arrangement as per this invention eliminates the top limit of lifting capacity caused by the loading and unloading procedures.

Characteristic for the invention is what is presented in the claims.

By means of the arrangement one is not tied to the cycle length in the manner that unloading from and loading into the mould carriage should be carried out within that time. Thanks to the arrangement the capacity of furnace can be increased substantially from known rates of 30 - 70 pieces per hour in present serial furnaces to a rate of 100 - 120 pieces per hour. By means of the arrangement both bent glass sheets and straight glass sheets to be loaded into the furnace are more easily handled than the ones today, because the moulds are better pulled forward for the period of glass sheet replacement in a special workplace for glass sheet changing.

In the following the invention is disclosed with reference to the enclosed drawing, where

Fig. 1 is a schematic side view of a furnace embodiment.

Fig. 2 is schematic view of a furnace embodiment from above furnished with the arrangement as per this invention.

Figure 1 shows a serial furnace from one side, which has an upper rail 3 and an lower rail 4. Glass sheet 9 for bending travels in mould carriage 8 on the upper rail from section 2a to another section 2b, 2 c etc. On the upper rail the glass sheet is heated up to bending temperature. On the lower rail bent glass sheets 10 travel in mould carriage 8 via cooling sections to the unloading and loading end, which comprises also the lift section. Other sections on top of one another are marked with section numbers 2a, 2b, 2c etc. During the cycle of the process each mould carriage 8 stops in the respective section. The cycle includes the transmission time of one carriage and the stop time of one carriage.

Figure 2 shows the furnace from above. On lower rail4 bent glass sheets 10 travel in mould carriages 8 in turns to section 2a. In the embodiment of figure 2 from section 2a lower rail the mould

with bent glass sheet 10b is shifted over to lift section 1, when carriage 8a with straight glass sheet 9d in the mould has been first elevated by the lift to upper rail 3. When glass sheet 10b and mould carriage 8b are on the lift section lower rail, the transmitter, whose turn it is, e.g. device 5, collects glass sheet 10b and the mould pulling them to the side station onto transmitter 5. The bent glass sheet10 is removed into pile 10. A straight glass sheet from pile 9 is mounted in the mould as replacement.

In the meantime transmitter 6 brings the mould and new glass sheet 9e to mould carriage 8b. Carriage 8b is elevated by the lift and the arrangement is ready to receive and move the next mould carriage 8c to section 1 regardless of whether on the rail a transmission cycle is unfinished or not. Transmitter 6 that has lastly brought a glass sheet takes the from first at section 1 arrived carriage 8c a mould and a glass sheet 10c and pulls the glass sheet aside for replacement.

Now mould carriage 8c is empty in section 1 and transmitter 5 brings the mould and a new glass sheet 9f into it. As soon as carriage 8c is elevated by the lift, mould carriage 8d, arrived at least at section 2b during the transmission cycle, is moved to section 1 and transmitter 5 picks up mould and glass sheet 10d. The transmitter that has lastly brought the mould and straight glass sheet to section 1, also takes the next at the section arrived bent glass sheet for transmission to the respective side station. By means of this arrangement the transmitters can, each in its turn, keep each mould aside for a longer time for glass sheet replacement.

In figure 1 section 2b is empty on the lower rail at the moment shown. One advantageous embodiment of the invention is that from section 2c the mould carriage travels forward still steered by the transmission cycle, i.e. pushed by the other carriages, but the carriage arrived at sections 2a and 2b or at least at section 2a is steered forward regardless of the transmission cycle. These

carriages are moved in turns to lift section 1 substantially at once when the lift section is empty. When in the arrangement at least one section 2a or 2b on the lower rail is purposely empty, the next carriage , for instance 8d, can freely enter the empty section not causing any forced transmission to the lift section in the arrangement as per this invention.

In the arrangement according to the invention there is one mould more than mould carriages 8. The extra mould (each mould in its turn) is in the side station, whereby in the unloading and loading situation the mould to be returned from the side station has no access back to the same carriage by which it was brought to the station. Thanks to the extra mould there is a remarkable increase of available unloading and loading time. If there is an even number of moulds, the glass sheet will return to the same side of the furnace from where it was taken to the furnace. This is important by mixed production with respect to storing and order.

In the following an example of a furnace, the capacity of which has been raised to a quantity of 100 pieces per hour by means of the arrangement of this invention.

Cycle length is	3600 sec./100 pieces = 36 sec. each
Loading lift up, time expenditure	4,5 sec.
Carriage into loading lift	4,5 sec.
Glass sheet collection	10 sec.
Glass sheet in	10 sec.
	Total 29 - 30 sec.

Glass sheet change is 2 x cycle length - above transmission times, i.e 72 sec. - 30 sec. = 42 sec.
In the side station on each side one has 42 sec. time to change glass sheet in the immobile mould. So there is more time than the cycle duration.

It is to be noticed that the time needed for moving the carriages

from one section to another needs not to be taken into consideration.

Most suitably transmitters 5 and 6 are fork trucks with forks lifting the mould and taking it to the side station. The side stations comprised in this invention bring about a remarkable growth of capacity. The furnace construction includes a control centre 11 to steer the furnace operation. Among other things, the control of the timing of transmitter 5 and 6 functions can be made automatic and synchronous with the shit over of mould carriages from section 2a to section 1.